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Assessment of Problems Associated with Artificial Insemination Services in Dairy Cattle in Debretabour Town, Ethiopia, 2015

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Abstract: Artificial insemination is recognized as the best biotechnological technique for increasing reproductive capacity and has received widespread application in farm animals. A cross sectional study was conducted from November 2014 to April 2015 with the objective of assessing the problems associated with artificial insemination service in dairy cattle in and around Debre Tabor town. In this survey, a structured questionnaire was used and 400 respondents were interviewed. Descriptive statistics were used for analysis of the data. According to the study result, 34.2% of the smallholder dairy farmers have got artificial insemination services regularly and without interruption while 65.8% do not use this service due to unavailability of artificial insemination technicians (44.8%), discontinuation of service on weekends and holidays (32.2%) and lack of inputs (25.0%) with statistical significance between kebele ($P<0.05$) for shortage of artificial insemination technicians (AITS) and inputs. Conception failure (38.3%), unavailability of artificial insemination technicians (19.5%), disease (32.5%) and both conception failure and unavailability of artificial insemination technicians (20.0%) were the major identified constraints of artificial insemination delivery system. From 275 no satisfied dairy farmers 111(42.0%) passed the date without breeding cows by artificial insemination and natural mating and also164 (58.0 %) used natural mating and waiting the next time to use artificial insemination services and statistically significant difference was found among dairy farmers. Similarly, from 125 satisfied dairy farmers 6(5.1%) passed the date without breeding the cow with artificial insemination and natural mating and also119 (42.0%) used natural mating and waiting the next cycle to use artificial insemination services. Mastitis, tuberculosis and problems associated with calving were the major disease that hindered proper breeding of AI service. Generally, the questionnaire surveys indicated that artificial insemination is not doing well in the study kebeles. Therefore, artificial insemination service requires urgent measures to change the situation to achieve success.

Key words: Artificial Insemination Constraints · Debretabour · Dairy Cattle

INTRODUCTION

The total cattle population for the rural sedentary areas of Ethiopia is estimated to be 43.12 million, of which 55.41% are females. Out of the total female cattle population, only 151,344 (0.35%) and 19,263 (0.04%) heads are hybrid and exotic breeds, respectively. With an average lactation length of 6 months and an average daily milk production of 1.44 liters per cow, the total milk produced during the year 2006/07 was recorded to be 2.634 billion liters. This suggests that the total number of both exotic and hybrid female cattle produced through the crossbreeding work for many decades in the country is quite insignificant indicating unsuccessful crossbreeding work. This again suggests that Ethiopia needs to work hard on improving the work of productive and reproductive performance improvements of cattle through appropriate breeding and related activities [1].

In spite of the presence of large and diverse animal genetic resources, the productivity (meat and milk) of livestock remains low in many developing countries including Ethiopia for various reasons such as inadequate nutrition, poor genetic potential, inadequate animal health services and other management related problems [2].

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Cattle breeding are mostly uncontrolled in Ethiopia making genetic improvement difficult and an appropriate bull selection criteria have not yet been established, applied and controlled [3]. Although artificial insemination, the most commonly used and valuable biotechnology has been in operation in Ethiopia for over 30 years, the efficiency and impact of the operation has not been well-documented [4]. It is widely believed that the artificial insemination (AI) service in the country has not been successful to improve reproductive performance of dairy industry [5]. AI service is weak and even declining due to inconsistent service in the smallholder livestock production systems of the Ethiopian highlands. The problem is more aggravated by wrong selection and management of AI bulls along with poor motivations and skills of inseminators [6]. Hence, the objectives of this research are:

- To asses and identify the problems associated with artificial insemination services in and around Debretabour town.
- To inspire the owners to use artificial insemination service for a better improvement of livestock production and productivity.
- To generate information for the better application on the sector and to recommend and give feedback to decision makers to take appropriate majors on it.

MATERIALS AND METHODS

Study Area: A cross sectional study was conducted from November, 2014 to April, 2015 in and around Debretabour Town. Debretabor is a town and woreda in north-central Ethiopia which is located in the South Gondar Zone of the Amhara Region, about 100 kilometers southeast of Gondar and 50 kilometers east of Lake Tana. This historic town has a latitude and longitude of 11°51'N 38°1'E11.850°N 38.017°E with an elevation of 2,706 meters (8,878 ft) above sea level. The presence of at least 48 springs in the area contributed to the development of Debre Tabor. Based on 2007 national census conducted by the central statistical agency of Ethiopia, this town has a total population of 5, 5596 of whom 27,644 are men and 27,952 women. The climate is warm and temperate. In winter there is much less rain fall than in summer. The average annual temperature is 15°C. The average annual rain fall is 1497 mm [7]. The livestock population in the area comprises of cattle (8,202), goat (22,590), sheep (2,695), horse (1,065) and donkey (9,001) [7]. Across-sectional study was conducted in five kebele (Ajbar, Woyblla, Abaregagn, Mello and Segogebeya) which were selected from in and around Debrer Tabour town. All the study areas were purposively selected because it was believed that these areas are the ones where an AI service is exercised.

Study Population: Artificial insemination technicians in Debretabour town, animal health professional and dairy cattle owners in five randomly selected kebeles were represented in the study population.

Study Design: A cross-sectional type of study supported by questionnaire survey was carried out from November 2014 to April 2015 in five randomly selected kebeles dairy owners and AITS live in and around Debretabour town.
Sample size determination and sampling procedures: The sample size was determined based on the expected prevalence of 50% and absolute desired precision of 5% at confidence level of 95% according to the formula provided by Thrusfield [8]. This is calculated by using the following formula:

$$n = \frac{n = 1.96^2 \times P_{exp}\ (1-P_{exp})}{d^2}$$

where,

n = Required sample size
P_{exp} = Expected prevalence
d^2 = Desired absolute precision (5%)

Based on this formula, the total numbers of respondents were 384. However, to increase the precision, a total number of respondents were rise into 400.

Data Collection Methods: *Questionnaire survey*-structured questionnaires were prepared to interview dairy cattle owners, AI technicians to collect data on the status of AI services and constraints associated with the service. In questionnaire survey, 400 respondents (390 dairy farmers, 4 animal health and production professional and 6 artificial insemination technicians) were interviewed and during the interview process, every respondent included in the study was briefed about the objective of the study before starting presenting the actual questions. Then the questions were presented to the respondents.

Data Management and Analysis: The data collected were entered and scored in Ms excel worksheet and coded and entered to SPSS version 16.0 statistical packages for windows and analysis were made. The data was summarized using descriptive statistics analysis such as percentages, tables and chi square.

RESULTS

Assessment of Artificial Insemination Problems: From 400 respondents data was collected by questionnaires survey in five selected kebeles found in and Debretabour town. A total of 280 (69.9) were not satisfied by artificial insemination service but only 120 (30.1%) were satisfied by artificial insemination service. There was statistically significant difference ($p<0.05$) among the kebeles in shortage of artificial insemination technician and shortage of input, but there is no statistically significant difference($P>0.05$) in the holidays services of weekends and in signs of estruses used in order to report cows for artificial insemination service in kebeles ($p>0.05$). The least artificial insemination service usages in weekends and holidays found in Woybla kebele was 6.1% (Table 1). The greatest shortage of AIT present in Ajbare kebele (74.5%) while the slightest in segnogebeya kebele 9 (11.0%). The chief value of shortage of input also present in Ajbare kebele (41.5%).

AI Service Problems Identified in the Study Site: AI service problems identified in the study site are conception failure, in availability of AITS and death. Among these conception failure was the most and higher in kebele Ajbbare (42%) and less in Abaregagne. Others problems of AI service summarized in (Table 2).

Assessment of Signs of Oestrus Used in Order to Report Cows to Be Inseminated for AI Service: The results of signs of estrus used in order to report cows to be inseminated for AI service in the study areas are presented in (Table 3). There was no statistically significant difference among the study areas in signs of estrus used to report cows to be inseminated for AI service ($p = 0.084$), which is ($p>0.05$).

Assessment of Problem from Dairy Owners: The results of cows and heifers pass without breeding from AI and natural mating in the study areas were presented in (Table 4). There was statistically significant difference among the study kebeles in pass without breeding from AI and natural mating ($P=0.00$). From 275 non-satisfied dairy farmers 111(42.0%) the cows and heifers passed without breeding from AI and natural mating and also 164 (58.0%) used natural mating and waiting the next time to use AI service.

There was statistically significant difference among the study kebele in used natural mating ($P=0.00$). From 280 non-satisfied dairy owners 102 (38.2%) the cows and heifers was used natural mating and also 178 (61.8%) was pass without breeding from AI and natural mating and waiting the next time to use AI service. The results in the study areas were presented in (Table 5).

Table 1: Artificial insemination used in different times and condition.

	WHS		SAITS		SI	
Kebele	Total	No	Total	Yes	Total	Yes
Ajbar	94	50(53.2)	94	70(74.5))	94	39(41.5)
mello	87	22(25.3)	87	29(33.3)	87	29(33.3)
segnogebeya	82	12(14.6)	82	9(11.0)	82	6(7.4)
Woyeblla	82	5(6.1)	82	21(25.6)	82	6(7.4)
Abaregagne	55	40(72.2)	55	50(90.9)	55	19(34.5)
Total	400	129(32.2)	400	179(44.8)	400	100(25.0)
X2	3.449	1.355	48.957			
P-Value	0.486	0.00	0.00			

Key: WHS=Weekends and holiday service. *SAIT*= Shortage of AI technicians, SI= Shortage of

Table 2: Major AI service problems identified in the study site

	Kebeles					
Problems of AI service	Ajbar	Mello	Segno gebeya	Woyblla	Abaregagne	Total No. of respondant (%)
Conception failure	36(38.3)	27(31.0)	38(46.3)	27(32.9)	19(34.5)	147(36.8)
In availability of AITS	17(18.1)	17(19.5)	6(7.3)	12(14.6)	10(18.2)	62(15.5)
Death	28(29.8)	33(37.9)	28(34.1)	25(30.5)	16(29.1)	130(32.5)
Conception failure and in availability of AITS	13(13.8)	10(11.5)	10(12.2)	18(20.0)	10(18.2)	61(15.2)
Total	94	87	82	82	55	400(100)

Table 3: The results of signs of estrus used to report cows for AI service

	Kebele							
Signs of estrus	Ajbar	Mello	Segno gebeya	Woyeiblla	Abaregagne	Total	X^2	P-value
Mount other cows	51(54.3)	52(59.8)	47(57.3)	46(56.1)	26(47.3)	222(55.5)		
Redness of vulva	13(13.8)	8(9.2)	5(6.1)	5(6.1)	6(10.9)	37(9.2)		
Inappetance	11(11.7)	13(14.9)	16(19.5)	12(14.6)	8(14.5)	60(15.0)		
Restlessness	19(20.2)	14(16.1)	17(20.7)	17(20.7)	13(23.6)	80(20.0)		
Total	94	87	82	82	55	400	17.201	0.373

Table 4: Cows pass without breeding from AI and natural mating

	Pass without breeding from AI and Natural mating				
Satisfaction	No	Yes	Total	X^2	P-value
Satisfied	119(42.0)	6(5.1)	125	66.892	0.00
Non_satisfied	164(58.0)	111(42.0)	275		
Total	283(70.0)	117(29.2)	400		

Table 5: One-way analysis of variance in the use of natural mating for cow and heifers

	Used Natural Mating			
Satisfaction	No	Yes	Total	P-value
Satisfied	110(38.2)	10(8.9)	120	0.00
Non_Satisfied	178(61.8)	102(38.2)	280	
Total	288(72.0)	112(28.0)	400	

Table 6: Awareness of AI beneficiaries on time of insemination during heat period

	Cows and heifers shown heat at afternoon		Cows and heifers shown heat at morning	
Time of insemination	N	%	N	%
After noon of that day	26	6.6	169	42.1
Morning of the next day	164	40.9	62	15.5
Afternoon of the next day	54	18.5	31	7.9
The day after the next day	36	9.0	0	0.0
At the time of AITs available	54	13.5	54	13.5
Morning of that day	0	0.0	22	5.5
Up to the next day	8	2.0	8	2.0
Immediately using bull	58	14.5	54	13.5

Table 7: Inbreeding problem in the study area

	Kebeles					
Problems	Ajbar	Mello	Segnogebeya	Woyblla	Abaregagne	Total No. of respondant (%)
Low genetic improvement	25(26.6)	24(27.6)	18(22.0)	15(18.3)	13(23.6)	95(23.8)
Low milk production	23(24.5)	8(9.2)	17(20.7)	17(20.7)	10(18.2)	75(18.8)
Low adaptability	35(37.2)	34(39.1)	27(32.9)	29(35.4)	16(29.1)	141(35.5)
Low genetic improvement and milk production	11(11.7)	21(24.1)	20(24.4)	21(25.6)	16(29.1)	89(22.2)
Total	94(23.5)	87(21.8)	82(20.5)	82(20.5)	55(13.8	400(100)

Table 8: Major problems associated with AI service

Animal health problems	Frequency	Percent (%)
Mastitis	111	27.7
Tuberculosis	56	14.0
Problems associated with calving	134	33.4
Mastitis and tuberculosis	26	6.7
Mastitis and problems associated with calving	35	8.7
All	38	9.5
Total	400	100

Perception of AI Beneficiaries on Insemination Time: The perception of AI beneficiaries' on time of insemination depends on sign of heat of dairy cattle. Therefore, when their cows and heifers shown heat afternoon of the day, 40.9% of households inseminate at morning of the next day and which is the right time of insemination but, the rest 59.1% of households inseminate their cows in the wrong time (Table 6).

Inbreeding Problem in the Study Area: The maximum perception of the respondents toward inbreeding problem was recorded in Ajjbar kebele 94 (23.5%) followed by mello 87 (21.8%) and the least is recorded in Abaregagne 55 kebele (13.8%) as summarized in (Table 7).

Assessment of Major Health Problems of Dairy Cattle: The major diseases reported in the study area were mastitis, respiratory diseases and problems associated with calving. Among the problems associated calving higher than others (Table 8).

DISCUSSIONS

Assessment of problems associated with artificial insemination services in and around Debretabor town was conducted on 400 respondents (dairy owners, animal health professionals and AI technicians) supported by questionnaire survey in five different kebeles. The research showed that from 400 cattle owners and AI technicians 280 (69.9%) were not satisfied in different ways in the use of AI service during the time of weekends and holidays, this was due to the shortage of AIT, shortage of input. On the other hand, 120 (30.1%) were satisfied in AI service, this result agrees with the reports of Dessalegn [9].

In all the study kebeles, there was statistically significant difference in shortage of AIT ($P<0.05$) this might be due to the cattle population and AI service were not synchronized. This agrees with the reports of Dessalegn [9]. Among the study kebeles, Segnogebeya had the least shortage of AI technicians which accounts about (11.0%) from the total study population where as the highest number of shortage of AI technicians were found in (90.9%). There was statistically significant difference among the study areas in shortage of inputs ($p<0.05$). This might be due to uneven distributions and production of semen in National Artificial Insemination Center (NAIC), Amhara Regional Administrative State Artificial Insemination Center (ARASAIC) and South Gondar zone artificial insemination center.

The present study revealed that 34.2% of the smallholder dairy farmers have got AI service regularly and without interruption while 65.8% of them do not due to unavailability of AITs 44.8%, discontinuation of service on weekends and holidays 32.2% and lack of inputs 25.0% with statistical significance between kebeles ($P<0.05$) for shortage of AITS and inputs which is higher than 27.7 % and 62.3% reported by Desaleng [9] and 30.2% and 59.8% by Ephrem [10], at Kaliti and Wolaita Sodo towns, respectively. In this study, there was statistically significant difference in shortage of AIT ($P<0.05$) among the kebeles, this might be due to uneven distribution of AITs and the number of dairy cattle owners which is in line with the findings of Desalegn [9] and Zerihun *et al.* [11].

The current study revealed that the AI beneficiaries use natural mating (38.2%) when the service discontinued due to different factors and postpone time of insemination for the next cycle of insemination (61.8%). These were the possible solutions of AI users when the service discontinuous due to holiday and absence of AITs during time of onset of heat which is comparable with 37.5% and 62.5% respectively at Jimma zone reported by Ibrahim *et al.* [12] and agrees with Zerihun *et al*. [11] and Zewdie *et al*. [13].

In this study period the major constraints of AI delivery system were stated in their order of importance here below. The most outstanding constraints of AI services were conception failure (38.3%), death or dystocia (32.5%), unavailability of AITS and conception failure (20.0%), unavailability of AITs (19.5%) in the study kebele, Ajbar, Mello, Mello and Woybla, respectively in order of their importance (Table 4). This study contradicts with the study of Ibrahim *et al.* [12] in which the overall most outstanding constraints of AI service identified in this study area were deficiency of inputs (10.4%), insufficiency of concerned body support (12.8%), conception failure (18%), shortage of AITs (31.3%), poor awareness creation in dairy farmers about the AI service (16.7%), insufficient distribution of AI center in the country (16.7%), inadequate budget allocation (8.3%),

disease (15.6%), problem of repeat breeding and ways of communication of dairy cattle owners with AITs. And also the present study was differ with the study of Tadesse [14] in which the most serious constraints of AI service were feed source, perception of AI users about AI, poor oestrous detection systems, efficiency of AITs, distance from local AIC, management of AI at official level, input for AI activity, price for AI and disease in the order of their importance. The major AI service constraints ranked as efficiency of AITs, heat detection systems, availability of AI service, perception of AI users about AI, distance from local AIC and price for AI the order of their importance according to the study done by Hayleyesus [15]. According to Damron [16], heat detection, AITs efficiency and fertility level of the herd was the most severe problems of AI service delivery.

Even though, different from my study result, all of them were exploiting or stating the major problems of AI service. The problem of repeat breeding was also mentioned by farmers and hence needs to be seriously addressed. High numbers of services per conception might be the results of problems associated with poor semen quality, poor semen handling practices, discontinuation of incentives to AI technician, season of breeding, management factors in relation to estrus detection, timing of insemination and poor insemination practices. Way of communication systems and long distance travelling to AI beneficiary are make the AI service challenge full farmers. As a result transportation, telephone, infrastructure and other agricultural practice need further attention for the development of AI activity. This problem in general might be due to the responsible bodies are not giving a proper attention to the AI services which indicates that decision makers need to work hard to improve the situations of AI operation in the study areas and also at national level widely. Concerning AI technicians, not only their skill problem, but also motivation, attitudes and the facilities available have profound influence on the outcome of AI service which might be resulted from lacks of job training and other incentives.

Among the study kebele in estrus detection about 55.5% of the dairy farmers detect their dairy cows by observing mounting of the cow on other animals, redness and mucus discharge of the vulva (9.2%), restlessness and nervousness (20.0%) and loss of appetite (15%).Majority of my result is higher than that reported by Milkessa [17] with 16.9% for mounting of the cow on other animals, 10% for redness and vulva discharge, 4.6% for bellowing and 3.1% for restlessness and reports of Ibrahim *et al.* [12] with 32.8% by observing mounting of the cow on other animals, redness and mucus discharge of the vulva (9%), restlessness and nervousness (6.6%) and loss of appetite (4.9%). This might be due to good management practice, absences of disease and awareness of the community about the detection system of oestrous in my study area.

About 83% of AI beneficiaries inseminate their cows and heifers at the right time of insemination. Thus, when the cow shows heat sign in the afternoon of the day and morning, they allow their cow to be inseminated at early morning of the next day and late afternoon of that day, respectively. This study has shown that when their cows and heifers shown heat afternoon of the day, 40.9% of households inseminate at morning of the next day and which is the right time of insemination but, the rest 59.1% of households inseminate their cows in the wrong. This study agree with Tadesse [14] found that respondents have inseminated their animals, when their cows and heifers shown heat afternoon of the day, 39.8% of households inseminate at morning of the next day and which is the right time of insemination but, the rest 60.2% of households inseminate their cows in the wrong time. And also our study shows that one fourth of AI users inseminate their cows at the incorrect time of insemination which is lower than the finding of Milkessa [17]. This difference could be due to the awareness of the community to AI service and due to the overall most outstanding constraints of AI service identified in this study area were deficiency of inputs 25.0%, insufficiency, shortage of AITs 44.8%, poor awareness creation in dairy farmers about the AI service and problem of ways of communication of dairy cattle owners with AITs.

Respondents, especially farmers, used different methods of heat detection, but they were incapable of differentiating the time of insemination based on PM-AM rule due to poor knowledge, awareness and perception about times of insemination. As a result the beneficiaries have been exposed to loss of time, money and energy to perform AI at the centers repeatedly. Therefore, not only artificial insemination technician's efficiency but also the perceptions of cattle owners have to be given a great and enough consideration for better understanding of the right insemination time of the cows. Otherwise, the trusts of the AI beneficiaries to AI technology has been reduced and start to blame it and genetics improvement of dairy cattle strongly challenged by such like factors.

In this study, the major disease that were interfering for the proper and successful an accomplishment of the AI service, are mastitis, tuberculosis, mastitis and problems associated with calving, mastitis and tuberculosis and problems associated with calving. From the above listed diseases, the highest and the lowest were problem associated with calving (33.0%) and mastitis with tuberculosis (6.7%), respectively. This study agrees with the study of Ibrahim *et al.* [12]. These disease conditions were more prevalence in this study, it might be due to the lack of awareness of farmers for taking their animals to the diagnosis purpose in the veterinary service institution.

CONCLUSIONS

The most important constraints associated with AI service in the study site include conception failure, AITs problem, insufficiency of concerned body support, loss of structural linkage between AI center and service giving units, absence of collaboration and regular communication between RAIC, zonal, district and other stakeholders and inadequate resource in terms of inputs and facilities. The repeat breeding situation was a very alarming finding. Similarly, the conception rates were found to be very low. Generally, AI service in and around Debre Tabour has been given little or no emphasis at the woreda and kebele level. Therefore, based on the above conclusions the following recommendations are forwarded:

- One national body responsible to coordinate and monitor AI service, herd recording and also livestock breeding programs needs to be established and be very well organized in human and material resources.
- Selection of bulls for AI should strictly follow the standard guidelines and procedures set for the purpose and also the national livestock development policies of the country.
- The private sector should be encouraged to be involved in the AI service sector but with strict control by an active breeding policy and trainings should be given at federal and/or zonal level to AIT to prevent artificial insemination failure.
- Establishment of a functional breeding policy and strategy should be given at most priority and each stakeholder and professional should work hard towards its implementation
- AI service provision should be restructured in such a way that it responds well to the breed improvement programs of the town and woreda.

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